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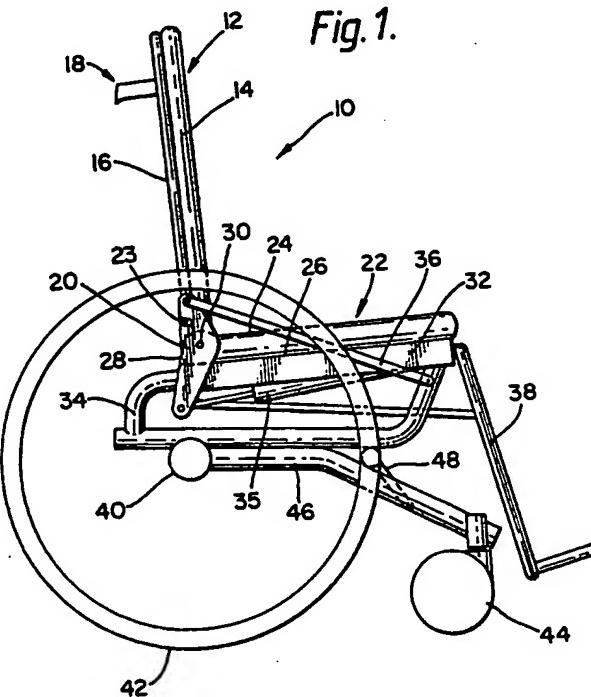
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### (54) Reclining chairs

(57) A reclining chair, such as a wheelchair 10, comprises a chair back 12, a chair seat 22, a seat support means 34 and a pivot stay means in the form of a pair of tie rods 36. The chair back 12 is pivotally mounted with respect to the chair seat 22, the chair seat 22 is slidably mounted with respect to the seat support means 34, and each of the tie rods 36 extends from a first point where it is pivotally mounted with respect to the seat support means 34 to a second point where it is pivotally mounted with respect to the chair back 12. As the chair back 12 is reclined, the chair seat 22 is caused to move forwards. This combination of movements compensates for the changing centre of gravity of an occupant with the result that the wheelchair 10 remains stable even with a shorter base than has hitherto been possible. For storage purposes, the chair back 12 can not only be folded forwards onto the chair seat 22, but both can be folded further forwards by arranging the seat support means 34 to be pivotally mounted about the rear axle 40.

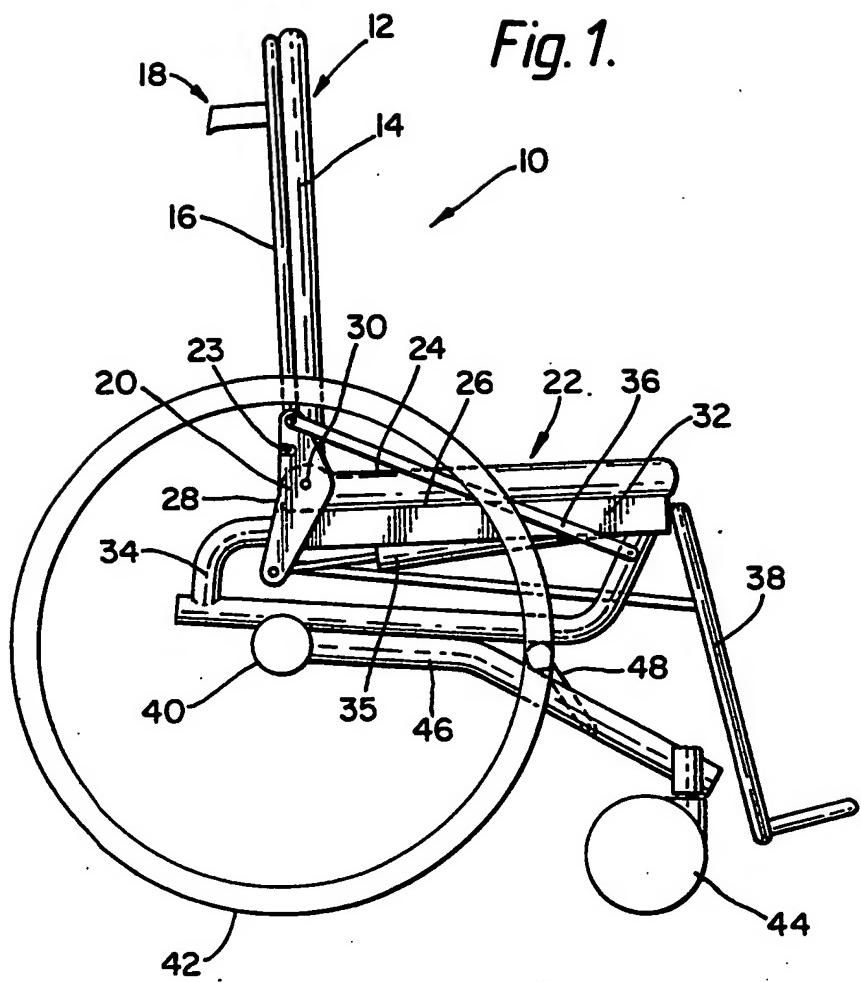


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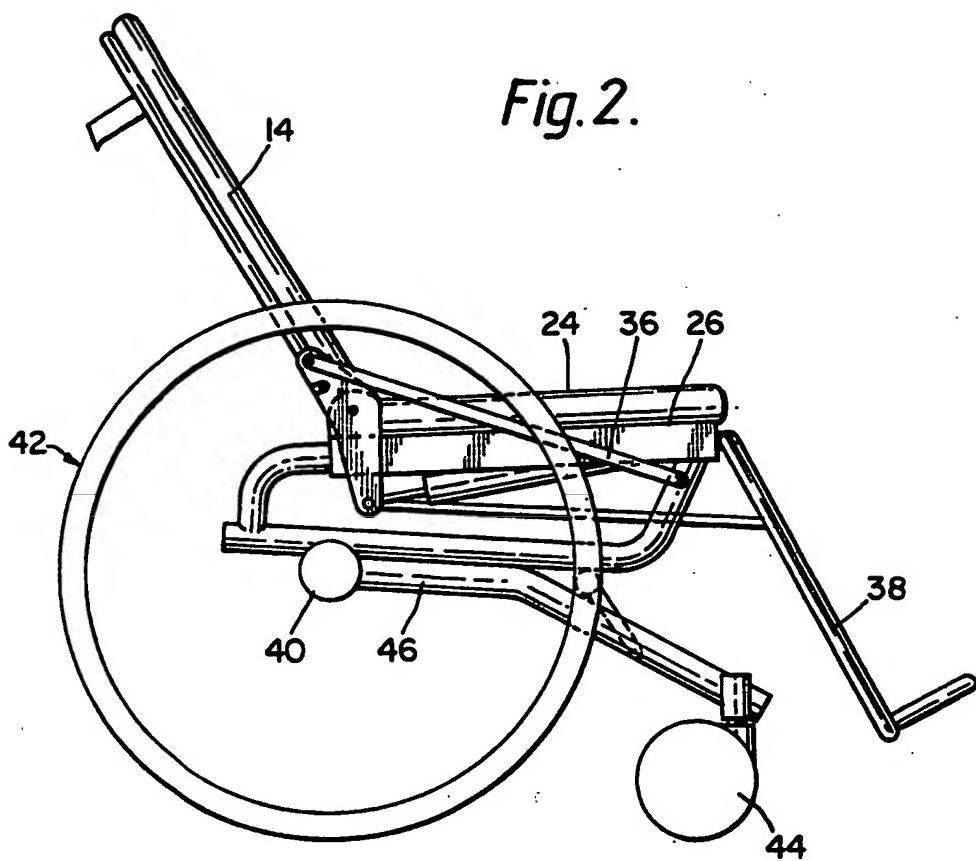
Fig. 1.



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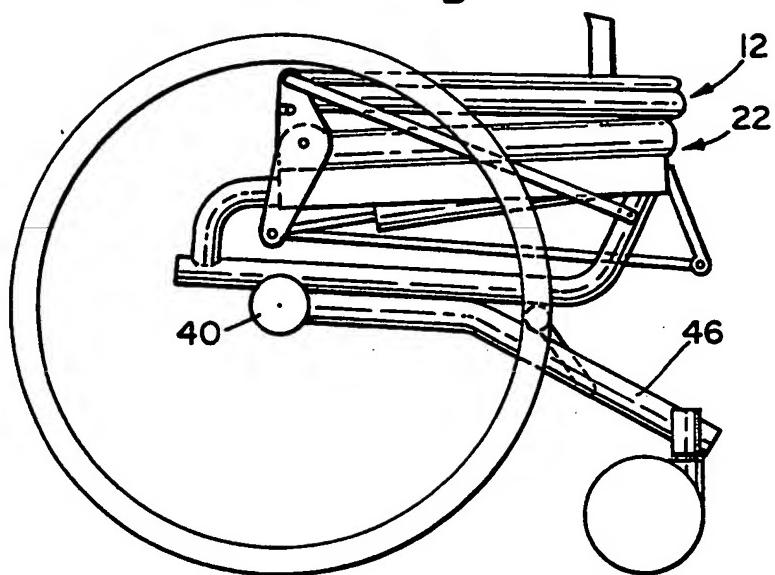
*Fig. 2.*



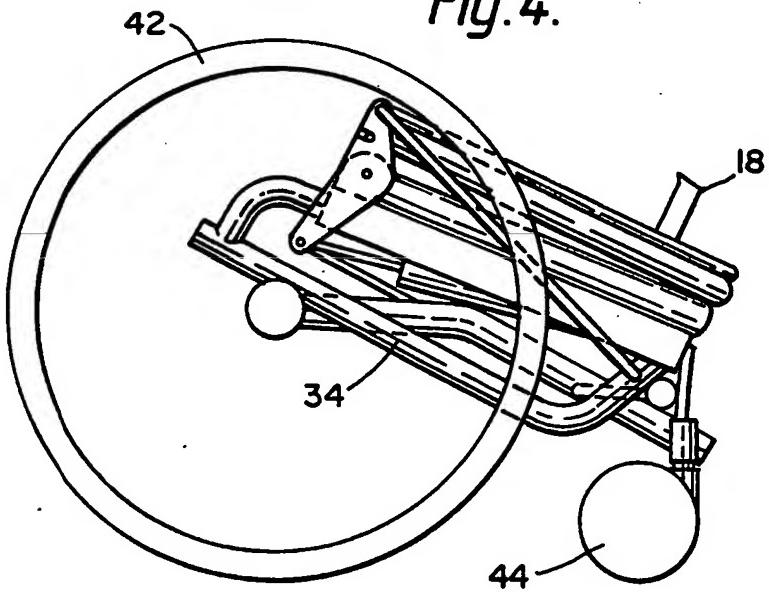
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*Fig. 3.*



*Fig. 4.*



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Fig.5.

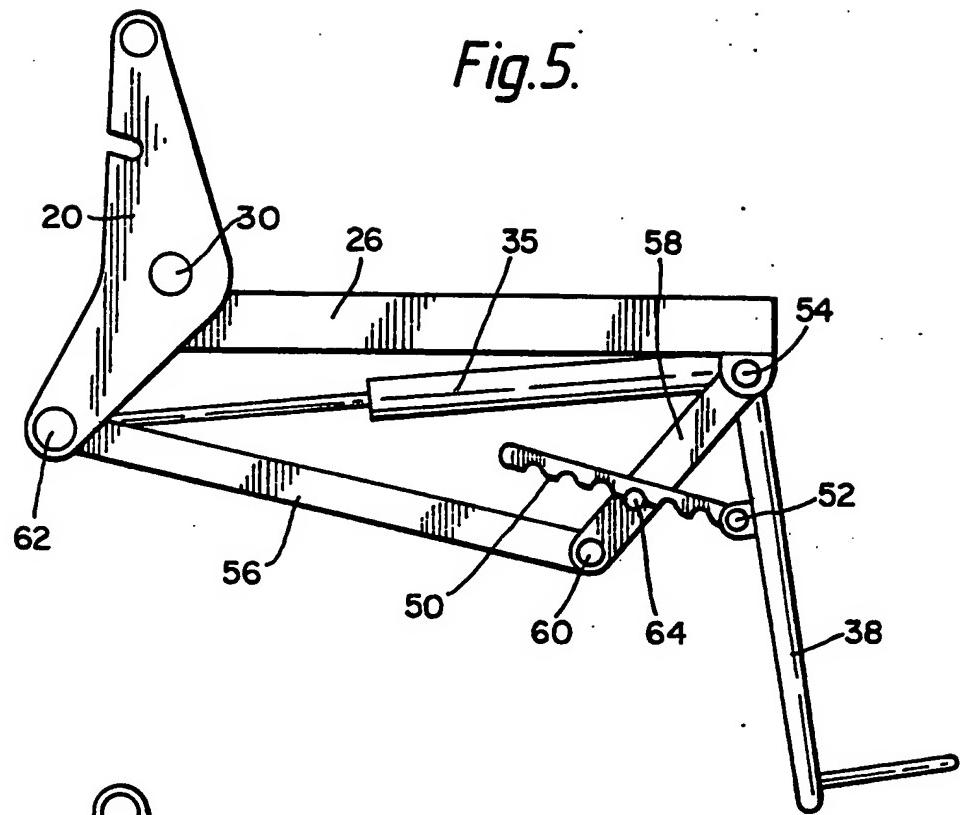
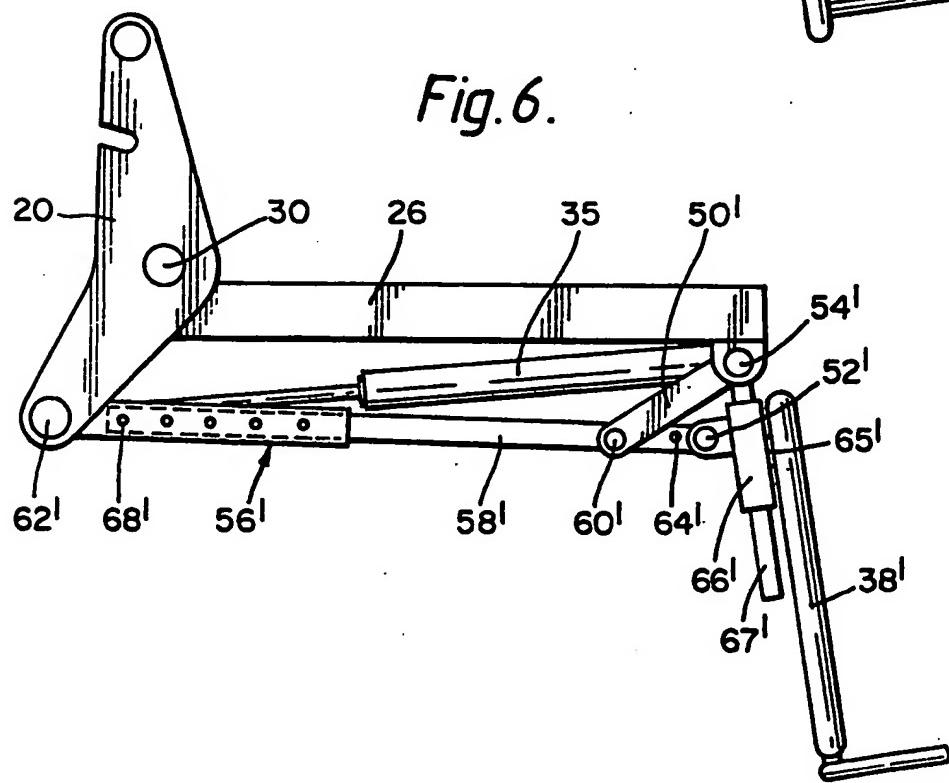


Fig.6.



**SPECIFICATION**  
**Reclining chairs**

- The present invention relates generally to chairs, and particularly concerns an improved pivot system for enabling a chair back and a chair seat to be inclined to one another at different selected angles, the present invention thus relating more specifically to reclining chairs.
- It is important to note that the reclining chairs or the present invention may find application as items of domestic furniture, such as armchairs or settees, whose outward appearance may be generally similar to that of conventional domestic furniture. In other words, they may include cushioning of considerable thickness with conventional coverings. They may also be mobile to the extent that the provision of castors facilitates transfer from one room to another. A preferred application of the reclining chairs of the present invention, however, is as wheelchairs for use by the disabled or infirm. The construction of the improved pivot system is such that the wheelchairs may include supportive and comfortable cushioning for both the chair back and the chair seat which blends with existing domestic furniture and may even match existing domestic furniture exactly.
- Traditionally, a reclining wheelchair has required a long base from the front wheels to the rear wheels, to ensure that when the chair back is reclined the shifting centre of gravity of the occupant does not cause the chair to become unstable, and possibly even tip backwards.
- Disadvantages of the need for a long wheel base, in comparison with a shorter wheel base, are that the chair is less compact and less easy to manoeuvre and requires a greater effort by an occupant or attendant to negotiate a kerb.
- A reclining chair in accordance with the present invention, however, comprises a chair back, a chair seat, a seat support means and a pivot stay means, the chair back being pivotally mounted with respect to the chair seat, the chair seat being slidably mounted with respect to the seat support means, and the pivot stay means extending from a first point where the pivot stay means is pivotally mounted with respect to the seat support means to a second point where the pivot stay means is pivotally mounted with respect to the chair back.
- The chair back, and the chair seat, may each well include a layer of cushioning carried by a supportive backing. The cushioning may be formed of a foamed plastics material, for example, and may be covered by an aesthetically attractive material such as a patterned fabric, or leather, or an imitation grained-effect plastics material. As in conventional domestic furniture, the cushioning may be locally compressed against the backing by a plurality of spaced-apart buttons-hooks. To permit reclining of the chair back with respect to the chair seat, they may include respective pairs of brackets having aligned apertures therein receiving a pair of pivot pins, each of the pivot pins being located at a respective side of the chair back and the chair seat, and extending through one of the brackets on the

chair back and one of the brackets on the chair seat. The brackets and the pivot pins may normally, but need not necessarily, be hidden from view by the cushioning.

- The invention is not restricted to the provision of a chair back or a chair seat of the above-described construction. The pivot stay means may include one or more tie rods extending between a part of the seat support means near the front of the chair seat and a part of the chair back near the pivotal mounting of the chair back to the chair seat. Preferably, there are two tie rods each of which is located at a respective side of the chair seat. The or each of the tie rods may be simply bent back on itself at one end where it passes through a hole in the seat support means, and may likewise be simply bent back on itself at its other end where it passes through a hole in the chair back. Most, if not all, of the length of the or each of the tie rods may be hidden from view by the cushioning of the chair back and the chair seat. The provision of the pivot stay means has the result that the chair seat is caused to move forwards as the chair back is reclined about its pivotal mounting with the chair seat. This combined reclining movement of the chair back and forward movement of the chair seat compensates for the changing centre of gravity of an occupant with the result that the chair remains stable even with a shorter base than has hitherto been possible.
- The invention is not restricted to the provision of a pivot stay means of the above-described construction. Preferably, one or more co-operating pairs of channels and runners are provided for guiding forwards and backwards sliding movement of the chair seat relatively to the seat support means. The seat support means may include two of the channels, forming part of a framework of the chair, with each of the channels being located at a respective side of the chair seat. The chair seat may lie in a horizontal plane, or a nearly horizontal plane, or may itself tilt backwards so that the front of the chair seat is at a higher level than the rear of the chair seat. Support for the weight of the chair seat, and any occupant, need not necessarily be provided by the chair framework solely through the channels, because the chair seat may also slide upon one or more other parts of the chair framework.
- It is possible that the resistance to sliding of the chair seat may be so great that a slight shift in the occupant's bodyweight will not be sufficient to cause the chair position to change. If, however, the resistance to sliding of the chair seat is not so great, the provision of a releasable seat locking means would be desirable to permit the chair seat to be maintained in a selected position relatively to the seat support means. The seat locking means would be movable between a disengaged position in which the chair seat is permitted to slide and an engaged position in which the chair seat is not permitted to slide. In one configuration, one or more seat catches are carried by the chair framework.
- There may be as many seat catches as there are

runners. These catches may be removably insertable into a selected one of a series of longitudinally separated holes formed along the length of the or each of the associated runners. Each 5 of the seat catches may be in the form of a stop projecting inwardly of the chair from one end of a bar whose other end is formed as a handle. The bar may be pivotally mounted along its length, and a spring may be provided for continuously urging the 10 stop through a hole in the channel and into an aligned hole in the runner located within the channel. Move the handle against the pressure of the spring will remove the stop from the hole in the runner but need not necessarily completely remove the stop from the hole in the channel.

15 The invention is not restricted to the provision of a releasable seat locking means.

Counter-balancing reclining means may be provided for influencing the angular setting of the 20 chair back relatively to the chair seat. The counter-

balancing reclining means preferably includes a pair of extensible and retractable telescopic gas or spring strut assemblies although merely one of said strut assemblies may be sufficient. Each respective 25 one of said brackets on the chair back may be extended downwards and pivotally mounted to one end of a respective strut assembly, with the other end of that strut assembly being pivotally mounted to a further respective bracket secured to the 30 slidable chair seat. When the chair back is pivotted backwards, each of the strut assemblies is telescoped into its retracted position from which it attempts to regain its extended position by pivoting the chair back forwards. This counter-balancing

35 pressure of each of the strut assemblies may assist the occupant to adjust position for reclining to sitting by providing a supportive force which causes forward movement of the chair back as soon as the load imposed by the occupant's bodyweight on the 40 chair back is reduced. However, it is possible for the releasable seat locking means to be incorporated into the counter-balancing reclining means, and be released by one or more operating levers which may act on either or both of the strut assemblies. In

45 an alternative arrangement, electrically-powered reclining means may be provided for controlling the angular setting of the chair back relatively to the chair seat. The electrically-powered reclining means may be provided in the form of one or more

50 extendible and retractable electric strut assemblies very similar to the above-noted gas or spring strut assemblies and fixed to the chair at the same mounting points. A small rechargeable battery may be carried by the chair, and there may be a hand held remote control so an occupant can operate the electrically-powered reclining means simply by pressing a button to pivot the chair back either forwards or backwards at will.

55 The invention is not restricted to the provision of counter-balancing reclining means or electrically-powered reclining means.

60 When the reclining chair of the present invention finds application as a wheelchair, the wheelchair will normally be provided with a pair of relatively small, swivel mounted front wheels and a pair of

65 relatively large, rotatably mounted rear wheels. The front wheels may be carried by respective front ends of a pair of side struts whose rear ends are fixed to a rear axle carrying the rear wheels. The side struts 70 and the rear axle may be regarded as forming wheel support means functionally separate from the seat support means. Each of the front wheels, rear wheels and side struts will normally be located at a respective side of the chair seat. Preferably, the rear 75 wheels would be detachably carried by the rear axle so that they could be removed for storage and transport purposes.

To permit even better storage and transport, the chair back and the chair seat could be arranged to be 80 folded down between the side struts. This may be achieved by initially releasing a back locking means which hold the chair back in position on its brackets. When released, the chair back is allowed to pivot

85 forwards, about a point on each of the brackets above its main pivot point, to come to rest on the chair seat. It may be possible, however, to pivot the chair back fully forwards onto the chair seat without the need for the releasable back locking means.

With the chair back folded down onto the chair seat, 90 the most compact state of the chair is achieved by releasing a frame locking means to allow the chair seat to pivot down between the side struts. More generally, the seat support means may be pivotally mounted with respect to the wheel support means, 95 and the releasable frame locking means may permit the seat support means to be pivoted relatively to the wheel support means between an occupant-receiving position and a storage position. The seat support means may be carried by, or include, a pair of support struts which are pivotally mounted about the rear axle.

In one arrangement, the frame locking means 105 includes one or more folding catches, the or each of which includes a bolt which is carried by the chair seat and is removably insertable into an open-ended tube carried by the associate side strut. When each of the bolts is in its tube, the chair seat is in its normal position ready for use by an occupant. When each of the bolts is removed from its tube, the entire 110 sub-assembly comprising the chair back, chair seat, channels, runners, tie rods and support struts is pivotable as a unit about the rear axle. The folding down movement of the chair back and the chair seat may be limited by engagement of the support struts 115 with lugs projecting inwardly from the side struts.

Preferably, there are two of the folding catches and they are operable simultaneously by a single handle. The handle may be formed on a bar which is pivotally mounted along its length to the underside 120 of the chair seat. Parts of the bar on opposite sides of its pivotal mounting to the chair seat may be connected to respective ones of the bolts which may be slidably mounted in respective housings. A pair of springs may be provided for continuously urging the bolts out of the housings and into the tubes carried by the side struts. Turning the bar against the pressure of the springs will simultaneously remove both the bolts from their associates tubes.

125 In another arrangement, the frame locking means includes a cross strut blocking means which is

pivotedly mounted to and extends between laterally opposed portions of the wheel support means. The cross strut blocking means may be of a generally U-shaped configuration including a pair of opposed arms which are pivotally mounted to the side struts. In a rear position, the cross strut blocking means may engage with the support struts of the seat support means and the side struts of the wheel support means to lock the chair seat in a position ready for use by an occupant. Release of the frame locking means is achieved by pivoting the cross strut blocking means forwards to permit passage of the support struts past the side struts.

The invention is not restricted to the provision of a releasable frame locking means.

Whatever the application of the reclining chair of the present invention, a leg rest means may be provided whose elevation might be manually or automatically adjustable. There may be a linkage which operates upon pivoting of the chair back relatively to the chair seat to adjust automatically the elevation of the leg rest means in synchronism with the angular setting of the chair back relatively to the chair seat. Preferably, the length as well as the elevation of the leg rest means is automatically adjustable. In any event, the leg rest means is preferably but not necessarily removable from the chair seat.

A reclining chair, and a modification thereof, in accordance with the present invention, will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a side view of a wheelchair embodying the present invention;

35 Figure 2 is a side view of the wheelchair with its chair back in a reclined attitude;

Figure 3 is a side view of the wheelchair with its leg rest detached and its chair back folded forwards onto its chair seat;

40 Figure 4 is a side view of the wheelchair with its chair back and its chair seat fully folded into a storage condition;

Figure 5 is a side view of an elevating leg rest assembly for the wheelchair; and

45 Figure 6 is a side view similar to Figure 5 but of an alternative leg rest assembly for the wheelchair.

A wheelchair 10 embodying the present invention is shown in the accompanying drawings and for convenience only the parts seen when viewed from one side will be described although the wheelchair is longitudinally symmetrical so that views of the other side will correspond.

The wheelchair 10 has a chair back 12, including cushioning 14 secured to a backing 16. The upper end of the backing 16 may be provided with a handle 18 for use by an attendant. The lower end of the backing 16 may be provided with a bracket 20 to enable the chair back 12 to be pivotally reclined with respect to a chair seat 22, and with a locking catch 23 to permit folding of the chair back 12 forwards onto the chair seat 22. The chair seat includes cushioning 24 which is secured to a backing 26 whose rear end may be provided with a bracket 28 (shown in dotted outline). A pivot pin 30 extends through aligned apertures in the bracket 20 of the chair back 12 and

the bracket 28 of the chair seat 22. The backing 26 of the chair seat 22 is provided with a member 32 which is longitudinally slidable on a member (not shown) which is part of a seat support 34. A telescopic gas strut assembly 35 may be provided to maintain the chair back 12 in a chosen reclining position. A tie rod 36 connects the seat support 34 to the bracket 20. More particularly, one end of the tie rod 36 is pivotally connected to the front end of the seat support 34, and the other end of the tie rod 36 is pivotally connected to the upper end of the bracket 20. The arrangement so far described is operable in a manner such that causing the chair back 12 to recline simultaneously causes the chair seat 22 to advance.

A leg rest 38 may be provided which is detachably securable to the chair seat 22 and must be detached to achieve the fully folded condition shown in Figure 4.

85 To achieve said fully folded condition, it should be appreciated that all of the parts so far described are movable as a sub-assembly by virtue of the seat support 34 being pivotally mounted on a rear axle 40. A rotatably mounted rear wheel 42 is detachably secured to one end of the rear axle 40. A swivel mounted front wheel 44 is carried by one end of a side strut 46 whose other end is rigidly secured to the rear axle 40. Pivoting a cross strut 48, from the rear position shown in Figure 1 to the forwards position shown in Figure 4, enables the seat support 34 to pivot about the rear axle 40 in a clockwise sense.

The elevating leg rest assembly, as shown in Figure 5, includes a leg rest 38 and an adjustable link

100 50 pivotally mounted to the leg rest at point 52. This assembly is detachable from the wheel for folding by unclipping the leg rest from its pivot point 54. Permanently fixed to the wheelchair are links 56 and 58 which can cause the leg rest 38 to be automatically elevated. These links are pivotally connected together at point 60 and are pivotally mounted to the wheelchair at points 54 and 62, which are the same points at which the strut assembly 35 is pivotally mounted to the wheelchair.

110 The link 58 has a stud 64 for selected engagement with a notch in the adjustable link 50. To raise the leg rest 38 on its own, that is without the chair back being reclined, it is pivotted up about the pivot point 54 and held in the desired elevated position by the adjustable link 50. This adjustable link 50 allows the leg rest 38 to be held at various angles of elevation due to its adjustability about the stud 64. For automatic elevation of the leg rest 38, that is to say caused by the action of the chair back reclining, the

120 link 56 moves forwards as the chair back reclines which causes the link 58 to pivot forwards. Because the link 58 is connected to the leg rest via the adjustable link 50, the pivoting forwards of the link 58 lifts the leg rest 38. The geometry of this

125 arrangement is such that the movement of the chair back and the leg rest are synchronized throughout their movement so that when the chair back is fully reclined the leg rest is correspondingly fully elevated. To recline the chair back without raising the leg rest 38, the adjustable link 50 is lifted so that

it is no longer engaged with the stud 64. In this position, the links 56 and 58 still pivot forwards as the chair back is reclined, but because the link 50 is disconnected this movement is not transmitted to the leg rest and it does not move.

The alternative leg rest assembly shown in Figure 6 includes a leg rest 38' detachable from the wheel chair for folding by unclipping the leg rest from its connecting catch 65'. The elevating assembly is permanently fixed to the chair and consists of an adjustable telescope 56', 58' connected at the back of the chair to bracket 20 via pivot' 62'. At the front of the chair the adjustable telescope is connected to an automatic lengthening assembly at pivot 52'. The automatic lengthening assembly consists of a slider 66' running on a guide rail 67' and a pivoting link 50' connected to the telescoping rod 58' at pivot 60'. As the leg rest is pivoted up into an elevated position it is caused also to extend as slider 66' moves down the guide rails 67'. To raise the leg rest on its own, that is, without the chair back being reclined, it is pivoted up about the pivot point 54' and held in the desired elevated position adjusting the length of the telescope 56', 58'. This adjustable telescope 56', 58' allows the leg rest 38' to be held at various angles of elevation due to its adjustability of length caused by depressing catch 64', which in turn allows stop 68' to be located into any one of a series of holes in part 56' corresponding to various angles of elevation. For automatic elevation of the leg rest 38', that is to say caused by the action of the chair back reclining, the telescope 56', 58', retains the same length and moves forward as the chair back reclines, causing the leg rest to elevate accordingly. The geometry of this arrangement is such that the movement of the chair back and the leg rest are synchronised throughout their movement so that when the chair back is fully reclined the leg rest is correspondingly fully elevated. To recline the chair back without raising the leg rest 38', the catch 64' is permanently depressed allowing the part 56' to slide freely over the part 58' as the back rest reclines. Thus, the movement of the back rest is not transmitted to the leg rest and it does not move.

#### CLAIMS

- 50 1. A reclining chair comprising a chair back, a chair seat, a seat support means and a pivot stay means, the chair back being pivotally mounted with respect to the chair seat, the chair seat being slidably mounted with respect to the seat support means, and the pivot stay means extending from a first point where the pivot stay means is pivotally mounted with respect to the seat support means to a second point where the pivot stay means is pivotally mounted with respect to the chair back.
- 55 2. A reclining chair according to claim 1, in which the chair back and the chair seat each includes a layer of cushioning carried by a supportive backing.
- 60 3. A reclining chair according to claim 1 or claim 55, 2, in which the pivot stay means includes one or

more tie rods extending between a pair of the seat support means near the front of the chair seat and a part of the chair back near the pivotal mounting of the chair back to the chair seat.

- 65 70 4. A reclining chair according to any one of the preceding claims, in which one or more co-operating pairs of channels and runners are provided for guiding forwards and backwards sliding movement of the chair seat relatively to the seat support means.
- 75 5. A reclining chair according to any one of the preceding claims, in which a releasable seat locking means is provided to permit the chair seat to be maintained in a selected position relative to the seat support means.
- 80 6. A reclining chair according to any one of claims 1 to 4, in which electrically-powered reclining means is provided for controlling the angular setting of the chair back relatively to the chair seat.
- 85 7. A reclining chair according to any one of claims 1 to 5, in which counter-balancing reclining means is provided for influencing the angular setting of the chair back relatively to the chair seat.
- 90 8. A reclining chair according to claim 6 or claim 7, in which the reclining means includes one or more extendible and retractable strut assemblies, one end of the or each strut assembly being pivotally mounted to the chair back at a respective bracket, said bracket also being intended for use in pivotally mounting the chair back with respect to the chair seat, and the other end of the or each strut assembly being pivotally mounted to the chair seat at a further respective bracket.
- 95 9. A reclining chair according to any one of the preceding claims when in the form of a wheelchair.
- 100 10. A reclining chair according to claim 9, in which the chair back is pivotable forwards onto the chair seat.
- 105 11. A reclining chair according to claim 10, in which a releasable back locking means is provided to permit the chair back to be pivoted forwards onto the chair seat.
- 110 12. A reclining chair according to any one of claims 9 to 11, in which the seat support means is pivotally mounted with respect to a wheel support means of the wheelchair, and a releasable frame locking means is provided to permit the seat support means to be pivoted relatively to the wheel support means between an occupant-receiving position and a storage position of the wheelchair.
- 115 120 13. A reclining chair according to claim 12, in which the releasable frame locking means includes a cross strut blocking means which is pivotally mounted to and extends between laterally opposed portions of the wheel support means.
- 125 14. A reclining chair according to any one of the preceding claims, in which a leg rest means is provided whose elevation is adjustable automatically in synchronism with the angular setting of the chair back relative to the chair seat.
- 130 15. A reclining chair according to claim 14, in

which the length as well as the elevation of the leg rest means is automatically adjustable.

16. A reclining chair substantially as hereinbefore

described with reference to Figures 1 to 5, or Figures 5 1 to 5 as modified by Figure 6, of the accompanying drawings.

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